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Altered subcutaneous adipose tissue parameters after switching ART-controlled HIV+ patients to raltegravir/maraviroc

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Short title: fat alterations induced by RAL/MVC

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Abstract

Objective: To evaluate the effect on anthropometric, metabolic and adipose tissue parameters of switching ART-controlled persons living with HIV (PLWH) from a protease-inhibitor regimen to raltegravir/maraviroc.

Design: Substudy of ROCnRAL-ANRS157 with investigation of subcutaneous abdominal adipose tissue (SCAT) biopsy at inclusion and study end.

Methods: We performed lipoaspiration of paired SCAT samples, histology on fresh/fixed samples and examined the transcriptomic profile analyzed using Illumina microarrays after RNA extraction. Statistical analyses used Wilcoxon-paired test.

Results: The patients (n=8) were mainly male (7/8), aged (mean $\pm$ SEM) 54.9 $\pm$ 1.2 years, BMI 26.1 $\pm$ 1.2 kg/m², CD4: 699 $\pm$ 56 cells/mm³, all viral load (VL)<50 copies/mL. After a follow-up of 6 $\pm$ 0.5 months, all PLWH remained with VL<50 copies/mL. BMI, trunk and limb fat amounts were unchanged yet systemic insulin resistance increased. Adipose tissue histology was unchanged except for borderline increased adipocyte diameter ($P=0.1$). Amongst the 16,094 RNA transcripts, 458 genes were up-regulated and 244 down-regulated. Analyses of the KEGG and GO databases, evaluating modifications in the main functional pathways, revealed that genes related to immune recognition/function were less expressed as were genes encoding T-cell receptor and receptor signaling pathways. The gene expression profiles indicated decreased

inflammation but genes involved in adipogenesis and insulin resistance were overexpressed.

Conclusion: After 6 months of raltegravir/maraviroc, adipogenesis-related gene profile was enhanced in SCAT, in agreement with a tendency for increased adipocyte size. Enhanced SCAT insulin resistance-related profile was concordant with higher systemic insulin resistance. However, immune activation/inflammation profile was globally lowered. We propose that raltegravir/maraviroc might favor SCAT gain but reduce inflammation/immune activation.

Key words

Subcutaneous adipose tissue, raltegravir, maraviroc, transcriptomics, histology, adipogenesis, inflammation/immune activation, insulin resistance

Introduction

Integrase strand transfer inhibitors (INSTI) are currently a highly recommended option in ART-naïve and also ART-experienced people living with HIV(PLWH) given their high and rapid efficacy and safe metabolic profile. However, some INSTIs (mainly dolutegravir and bictegravir but also raltegravir) have been recently associated with a global weight and fat mass gain^[1]. Even if the mechanisms remain elusive, we have previously shown that some INSTIs induced adipocyte hypertrophy, adipose tissue (AT) fibrosis and insulin resistance^[2]. However, in this previous work evaluating PLWH with severe obesity, we could only cross-compare AT samples issued from INSTI-treated or INSTI-untreated PLWH. The ROCnRAL study (Clinical-Trials.gov: NCT1420523), evaluated the efficacy of a dual therapy associating an INSTI, raltegravir, to the CCR5 inhibitor, maraviroc, in patients suppressed on a protease-inhibitor (PI)-containing regimen but was prematurely stopped due to insufficient virologic control^[3]. Herein, we analyzed SCAT individual variation before and 6 months after raltegravir/maraviroc initiation.

Increased weight/fat has been reported in PLWH who received some PI-based treatment^[1]. Due to PI-related increased risk of cardiometabolic diseases, aging PLWH have been often switched to an INSTI-based therapy due to the lipid-lowering effect of INSTI^[4-6]. However, INSTI-related weight/fat gain also raises concern regarding increased cardiometabolic risk. This risk has not been yet clearly shown for cardiovascular diseases. Regarding insulin resistance and diabetes, results are discrepant^[4, 7].

Otherwise, maraviroc has been associated with changes in immune profile and a favorable effect on cardiovascular parameters in PLWH^[8, 9]. Moreover, maraviroc may exert anti-fibrotic effects on the liver^[10, 11].

We performed a careful investigation of patients from the ROCnRAL study and examined the individual evolution of anthropometric, metabolic, inflammatory and AT parameters six months after initiation of the dual raltegravir/maraviroc therapy.

Patients and methods

Patients

Seventeen patients were enrolled into the ROCnRAL fat sub-study prior to study discontinuation. Eight had subcutaneous-AT (SCAT) biopsies both at initiation and end: they were aged (mean $\pm$ SEM) 54.9 $\pm$ 1.2 years at inclusion, 87% male, 87% Caucasian, 13% African, CD4 699 $\pm$ 56 cells/mm³, VL<50 copies/mL. They received raltegravir/maraviroc for a mean duration of 6 $\pm$ 0.5 months.

Systemic markers

Adiponectin, leptin and inflammatory markers (hsCRP, hsIL-6, sCD14, sCD163) were measured on stored serum samples by immunonephelometry or ELISA^[12]. Insulin resistance was measured by the quantitative insulin sensitivity check index (QUICKI) = $1/[\log(G_b) + \log(I_b)]$ where G_b is fasting plasma glucose (milligrams per deciliter), and I_b is fasting plasma insulin (microunits per milliliter).

Fat collection and histology

Subcutaneous-AT(SCAT) samples were collected by a single operator (JPB) by needle lipoaspiration from the periumbilical area under local anesthesia.

Histology was analyzed on fresh tissue to evaluate adipocyte size/volume and on fixed tissue to evaluate fibrosis by Sirius Red staining (scored using arbitrary units 0-3)^[13].

mRNA extraction and transcriptomics

Total RNA was extracted using a RNeasy total-RNA minikit (QIAGEN, Verlo, The Netherlands), quality/concentration assessed (Agilent-2100 bioanalyzer, Agilent-Technologies, Santa-Clara, USA) and biotin-labeled complementary-RNA obtained (Ambion, Thermo-Fischer-Scientific, Waltham, USA). Hybridization processes used Illumina human HT-12 version-4.0 Expression BeadChips (Illumina-Inc, San-Diego, USA). Probes were detected using an Illumina-BeadArray Reader^[14].

Raw data were extracted using the numerical results (Illumina Genome-Studio 2011.1 software). The group comparisons used Student's *t* test. To estimate the false-discovery-rate, we filtered the resulting *P* values at 5% and used the Benjamini-Hochberg procedure^[14]. In the 16 paired samples, 80% of genes had valid expression. The Significance Analysis of Microarrays (SAM), shown as a switch R plot, indicated the genes significantly up- and down-regulated after the switch (suppl Figure 1). An automated annotation procedure of the differentially expressed genes used the KEGG (Kyoto Encyclopedia of Genes and Genomes) or GO (Gene Ontology) annotation databases. Functional analyses used the FunNet package.

Statistics

The paired results were compared using Wilcoxon-test (significant $P < 5\%$, Prism and Statview software). Transcriptomics results were adjusted for multiple testing (significant $q < 5\%$, SAM package).

Results

All patients remained controlled (VL < 50 copies/mL) with unmodified CD4 and CD8 levels (Table 1). BMI was unchanged after 6 months, as waist circumference, waist-to-hip ratio, trunk and limb fat amounts. However, hip circumference increased from 94.9 to 99.1 cm ($P = 0.03$). Regarding metabolic parameters, insulin increased (10.7 to 21.5 mU/L, $p < 0.05$). To evaluate insulin resistance, we used QUICKI, better correlated to the gold standard euglycemic hyper-insulinemic clamp IS value than HOMA-IR^[15]: QUICKI decreased from 0.342 to 0.315 ($P < 0.05$), in favor of increased insulin resistance. The level of adiponectin and inflammatory/immune activation markers (hsCRP, hsIL-6, sCD14, sCD163) was unmodified but leptin tended to increase ($P = 0.08$, Table 1).

Adipose tissue histology revealed that adipocyte diameter and volume increased yet not reaching significance ($P = 0.10$). The level of parenchyma fibrosis remained unchanged.

Transcriptomic analysis performed in the 16 paired samples identified 16,094 expressed RNA transcripts: 244 genes were down-regulated with a fold-change of 0.66 to 0.9 and 458 genes up-regulated with a fold-change of 1.1 to 10.6 (supplemental Tables 1 and 2).

Using the GO database, the gene network (Fig 1) revealed globally increased DNA replication and transcription, suggesting AT remodeling. Importantly, T-cell receptor signaling pathway was down-regulated as were pathways related to viral infection. Using the KEGG annotation database (Suppl Fig 2), the most enriched function was ubiquitin-mediated proteolysis (19.4%) and the main impoverished function (29.7%) was related to ribosomes involved in protein synthesis, indicating major switch-induced protein remodeling. Functions related to immune cell recognition and immune-related diseases were down-regulated.

Among the individual down- and up-regulated genes, we selected those with the larger amplitude of variation (less than $\times 0.8$ or more than $\times 3$). Two main categories were affected: *i*) genes expressed in immune cells and involved into T-cell and macrophage activation, and *ii*) genes involved into adipogenesis and insulin sensitivity in adipocytes. Among down-regulated immune-related genes, several encode proteins from the TCR superfamily: CD247 $\times 0.7$, TNFRSF4 (tumor-necrosis-factor receptor superfamily member-4) $\times 0.7$, CD3D (CD3 molecule δ in the CD3-TCR complex) $\times 0.7$. Other genes encode proteins expressed in T-cells: IL7R $\times 0.7$ and GIMAP4 (GTPase, IMAP-family-member-4) $\times 0.7$ in the IL7R pathway, GZMB (granzyme B) $\times 0.7$, CD58 $\times 0.8$, SEMA4D (semaphoring-4D) $\times 0.8$, in favor of a decreased level of T-lymphocytes within AT.

Several immune-related genes were upregulated as genes expressed in macrophages favoring the M2 versus M1 phenotype: DAB2/CD11b $\times 4.7$, FOXO3 (forkhead-box-O3) $\times 3.9$, TCF4 (transcription factor-4) $\times 3.6$, CREB1 (cAMP-responsive-element-binding-protein-1) $\times 3.5$, IL10 $\times 3.1$. A number of genes were involved into decreased T-

lymphocyte immune activation: MAGT1 (magnesium transporter-1) x5.3, DAB2/CD11b x4.7, IL17RD (IL17 receptor-D) x4.0. Also, genes encoding proteins inhibiting NF κ B and decreasing inflammation were up-regulated: CDKN2AIPNL (CDKN2A-interacting-protein-N-terminal-like) x7.7, DUSP19 (dual-specificity phosphatase-19) x5.6, KLF6 (Kruppel-like factor-6) x5.5, TRIM3 (tripartite-motif-containing-13) x3.3, while few genes were positively involved into inflammation as SEMA3E (semaphoring-3E) x4.9. Taken as a whole, the gene expression profile suggested decreased T-lymphocytes number/activation and a shift to a M2 macrophage phenotype together with increased expression of anti-inflammatory genes.

Otherwise, up-regulated expression was observed for genes involved into adipogenesis: KLF6 x5.5, QRFRR (polyglutamated RF-amide peptide receptor) x5.5, CREB1 x5.0, FOXO3 x3.9, TRIM13 x3.3, DLC1 (deleted-in-liver-cancer-1) x3.3, IL10 x3.1.

Also, several genes in the insulin signaling pathways involved into increased insulin resistance were up-regulated: SEMA3E x4.9, PIP5K2B (phosphatidylinositol-5-phosphate-4-kinase, typeII β) x3.7, IL10 x3.1, while LEPROT (leptin-receptor-overlapping-transcript) x5.4 is related to insulin signaling.

Discussion

We report here that ART-suppressed PLWH switched to raltegravir/maraviroc presented metabolic and adipose tissue modifications over six months. While BMI and fat mass did not change, hip circumference increased indicating fat redistribution. Likewise, insulin resistance, evaluated by fasting glycemia/insulin levels, increased. SCAT exhibited enhanced expression of genes associated with adipogenesis and insulin resistance.

Otherwise, expression of genes related to T-lymphocytes was reduced and the gene profile suggested a shift towards decreased AT inflammation and a M2 anti-inflammatory macrophage phenotype.

INSTI have been recently associated with a global fat mass gain. We previously reported increased adipogenesis induced by dolutegravir and raltegravir *in vitro* together with adipocyte hypertrophy in SCAT and visceral AT samples issued from INSTI-treated PLWH and macaques^[2]. Our present results are in good accordance. The fact that the two main categories of modified genes are involved into protein degradation/synthesis enlightens the marked effect of ART *versus* HIV on fat. Indeed, only switching ART regimen, without CD4 or VL change, deeply affected AT. Previous *in vitro* studies indicated that maraviroc was neutral regarding adipocyte differentiation^[16]. Thus, increased adipogenesis, suggested by the gene expression profile, and borderline increased adipocyte size might result from the effect of raltegravir.

Regarding inflammation, in accordance with our present results, we observed in SCAT samples from obese PLWH the absence of inflammation (macrophage infiltration with crown-like structures) in samples issued from INSTI-treated patients by contrast to non-INSTI PLWH and HIV-negative controls^[17]. Interestingly, increased weight in INSTI-treated PLWH was associated with decreased VAT density suggesting a lower inflammation level^[18]. Therefore, INSTI could reduce AT inflammation and immune activation. Maraviroc was previously shown to decrease inflammatory cytokine expression in cultured adipocytes^[16] and macrophage recruitment in AT induced by a

high-fat diet in mice^[19]. Thus, both raltegravir and maraviroc could explain the decreased expression of immune and inflammation-related genes.

Switching to raltegravir/maraviroc was associated with surrogate markers of systemic insulin resistance, probably ART-related. Indeed, BMI remained unmodified and increased hip circumference is generally associated with a favorable metabolic profile. Accordingly, the expression of genes involved in insulin resistance was enhanced in agreement with *in vitro* studies using raltegravir^[2]. Since maraviroc has not been reported to affect insulin sensitivity in PLWH and in endothelial cells^[20], it is reasonable to hypothesize that the gene profile favoring insulin resistance is related to raltegravir. Clinical studies report discrepant data. We recently reported increased insulin resistance in patients switching from a PI-based regimen to raltegravir-etravirine^[21] while, in a similar context, authors concluded that raltegravir increased insulin sensitivity^[4].

AT fibrosis adversely impacts metabolic parameters^[22]. We did not observe any modification in the level of global fibrosis in SCAT and only a few genes which expression was modified were directly related to collagen remodeling. We previously reported increased fibrosis in SCAT of INSTI-treated severely obese PLWH^[2]. However, maraviroc reduces fibrosis in the liver, and is now evaluated in that setting in clinical trials in PLWH with non-alcoholic-fatty-liver disease^[10, 11]. It might also be anti-fibrotic on AT. Possibly, treatment with both raltegravir and maraviroc could be globally neutral regarding AT fibrosis.

Circulating levels of adipokines and cytokines remained unchanged but our study lacked potency. Clinical trials using raltegravir or dolutegravir report, or not, modification in the level of these markers^[4, 5, 23]. Likewise, maraviroc markedly improved atherosclerotic progression in HIV-suppressed PLWH at high cardiovascular risk^[8], but the beneficial effect on the arterial wall was local and not associated with decreased inflammatory systemic markers.

Our study has limitations. Due to premature discontinuation, a small number of patients was enrolled. However, patients monitoring was careful with reliable AT samples withdrawn before and 6 months after the switch, allowing individual comparison. We could not verify the individual level of gene expression nor the change in protein expression and therefore our propositions regarding gene expression variations remain hypothetical. We cannot address the effect of raltegravir *versus* maraviroc. As well, we cannot analyze the effect of each ART molecules received before switching. Insulin resistance was evaluated by using the surrogate QUICKI index based only on fasting glucose and insulin levels but which was shown more accurate than HOMA-IR^[15].

In conclusion, in a small group of well-controlled PLWH, we observed that raltegravir/maraviroc markedly altered AT transcriptome suggesting increased adipogenesis, probably latter resulting in fat mass gain. Also, insulin resistance increased stressing for the risk of diabetes, requiring a careful follow-up. However, we observed a striking reduction in the expression of immune/inflammation-related genes. These

preliminary lead to interesting hypotheses which need to be confirmed in larger studies as they may impact the use of INSTI in some populations.

Legend of figures

Figure 1: Network analysis with the GO biological process annotation of genes with altered expression 6 months after switch to raltegravir/maraviroc

Green: decreased expression

Red: increased expression

Supplemental Figure 1: Significance Analysis of Microarrays (SAM) analysis of comparative adipose tissue gene expression after versus before the switch to raltegravir/maraviroc

Supplemental Figure 2: Functional analysis by using the KEGG database of adipose tissue genes up- or down-regulated after switch to raltegravir/maraviroc

Green: decreased expression

Red: increased expression

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JPB performed all the lipoaspirations.

VP, RA, JPB, SF, EC and EP have performed all the assays presented in this paper and participated to their analysis.

LA has monitored the ROCnRAL study

VP, LA, JPB and JC have performed the analysis of the data

CK has participated to the study as the PI of the ROCnRAL study

JPB, JC, CK and KC have written the grant proposition

JC has written the first draft, BF, JAW, KC and CK have participated to the redaction and all the authors have participated to the correction of the paper

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Table 1

Characteristics of PLWH included in the ROCnRAL sub-study with paired adipose tissue biopsies: clinical and metabolic parameters, adipokines and inflammatory markers, adipose tissue parameters.

The results are expressed as mean (SEM). The differences between T0 (inclusion) and *Tend* was calculated by using the Wilcoxon-paired test.

	T0	<i>Tend</i>	<i>P</i>
CD4 cells/mm ³	699 (56)	612 (23)	0.219
CD8 cells/mm ³	786 (100)	820 (111)	0.359
BMI kg/m ²	26.1 (1.2)	26.4 (1.3)	0.578
WC cm	94.6 (2.2)	97.9 (4.0)	0.250
HC cm	94.9 (1.8)	99.1 (2.1)	0.031
WHR	1.00 (0.02)	0.98 (0.02)	0.250
Trunk fat kg	13.2 (1.4)	13.6 (1.8)	0.562
Limb fat kg	8.0 (1.2)	8.1 (1.2)	0.312
Glycemia mmol/L	5.1 (0.2)	5.5 (0.25)	0.250
Triglycerides mmol/L	2.0 (0.9)	1.3 (0.2)	0.437
HDL-cholesterol mmol/L	1.35 (0.14)	1.5 (0.12)	0.219
LDL-cholesterol mmol/L	3.3 (0.33)	2.8 (0.24)	0.219
Insulinemia mU/L	10.7 (1.8)	21.5 (10.0)	0.047
QUICKI	0.342 (0.011)	0.315 (0.017)	0.046

hsCRP mg/L	2.61 (1.06)	3.8 (1.7)	0.578
hsIL-6 pg/L	4.5 (2.5)	2.7 (0.9)	0.937
Adiponectin mg/L	3.9 (0.8)	4.4 (1.1)	0.937
Leptin $\mu\text{g/L}$	12.4 (4.4)	18.2 (5.1)	0.078
sCD14 ng/ml	1583 (71)	1471 (101)	0.219
sCD163 ng/ml	699 (103)	790 (151)	0.467
Adipocyte diameter μm	106.9 (2.1)	113 (4.1)	0.109
Adipocyte volume $\times 10^3 \mu\text{m}^3$	649 (38)	776 (78)	0.109
Adipose tissue fibrosis AU	1.37 (0.26)	1.56 (0.35)	0.999

WC: waist circumference, HC: hip circumference, WHR: waist to hip ratio, HDL: high density lipoproteins, LDL: low density lipoproteins, AU: arbitrary unit

Figure 1

Green: decreased expression
Red: increased expression

<u>Gene ID</u>	<u>ID</u>	<u>Gene symbol</u>	<u>Name</u>	<u>Fold Change-value(%)</u>	
ILMN_168290	4818	NKG7	natural killer cell group 7 sequence	0,7	1,8141
ILMN_237760	919	CD247	CD247 molecule	0,7	1,2499
ILMN_212060	7102	TSPAN7	tetraspanin 7	0,7	1,8141
ILMN_167680	84417	C2orf40	chromosome 2 open reading frame 40	0,7	2,0799
ILMN_210940	3002	GZMB	granzyme B (granzyme 2, cytotoxic T-ly	0,7	2,0799
ILMN_176950	83700	JAM3	junctional adhesion molecule 3	0,7	1,5007
ILMN_174940	8502	PKP4	plakophilin 4	0,7	2,0799
ILMN_211220	7293	TNFRSF4	tumor necrosis factor receptor superfam	0,7	2,6244
ILMN_220900	6231	RPS26	ribosomal protein S26	0,7	2,0799
ILMN_167690	919	CD247	CD247 molecule	0,7	1,5007
ILMN_208620	114826	SMYD4	SET and MYND domain containing 4	0,7	2,0799
ILMN_178750	8848	TSC22D1	TSC22 domain family, member 1	0,7	1,2499
ILMN_323680	57523	NYNRIN	NYN domain and retroviral integrase co	0,7	2,0799
ILMN_240630	10616	RBCK1	RanBP-type and C3HC4-type zinc finger	0,7	2,0799
ILMN_177070	83543	AIF1L	allograft inflammatory factor 1-like	0,7	2,0799
ILMN_325170	79002	C19orf43	chromosome 19 open reading frame 43	0,7	2,6244
ILMN_226140	915	CD3D	CD3d molecule, delta (CD3-TCR comple	0,7	1,2499
ILMN_211230	10589	DRAP1	DR1-associated protein 1 (negative cofa	0,7	2,6244
ILMN_167230	58494	JAM2	junctional adhesion molecule 2	0,7	0,0000
ILMN_176960	5878	RAB5C	RAB5C, member RAS oncogene family	0,7	2,6244
ILMN_169130	3575	IL7R	interleukin 7 receptor	0,7	1,8141
ILMN_231620	84525	HOPX	HOP homeobox	0,7	1,5007
ILMN_174840	55303	GIMAP4	GTPase, IMAP family member 4	0,7	2,0799
ILMN_171710	3476	IGBP1	immunoglobulin (CD79A) binding prote	0,8	2,0799
ILMN_325020	29767	TMOD2	tropomodulin 2 (neuronal)	0,8	1,8141
ILMN_178160	716	C1S	complement component 1, s subcompo	0,8	1,8141
ILMN_177610	283298	OLFML1	olfactomedin-like 1	0,8	0,8244
ILMN_318890	441951	C20orf199	ZNFX1 antisense RNA 1 (non-protein co	0,8	1,0331
ILMN_324330	343990	C2orf55	chromosome 2 open reading frame 55	0,8	0,0000
ILMN_173190	6329	SCN4A	sodium channel, voltage-gated, type IV	0,8	1,8141
ILMN_167040	79171	RBM42	RNA binding motif protein 42	0,8	2,6244
ILMN_217480	146894	CD300LG	CD300 molecule-like family member g	0,8	2,0799
ILMN_178520	965	CD58	CD58 molecule	0,8	2,0799
ILMN_180570	5214	PFKP	phosphofructokinase, platelet	0,8	2,6244
ILMN_168750	10507	SEMA4D	sema domain, immunoglobulin domain	0,8	1,2499
ILMN_165120	255877	BCL6B	B-cell CLL/lymphoma 6, member B	0,8	2,6244
ILMN_169840	3609	ILF3	interleukin enhancer binding factor 3, s	0,8	2,0799
ILMN_238820	9862	MED24	mediator complex subunit 24	0,8	2,6244
ILMN_180600	5720	PSME1	proteasome (prosome, macropain) acti	0,8	2,6244
ILMN_238410	9289	GPR56	G protein-coupled receptor 56	0,8	1,8141
ILMN_176950	54453	RIN2	Ras and Rab interactor 2	0,8	2,0799
ILMN_175450	9828	ARHGEF17	Rho guanine nucleotide exchange facto	0,8	1,5007
ILMN_168900	79673	ZNF329	zinc finger protein 329	0,8	2,6244
ILMN_165820	6139	RPL17	ribosomal protein L17	0,8	1,8141
ILMN_325140	9804	TOMM20	translocase of outer mitochondrial mer	0,8	1,5007

ILMN_215744	3122	HLA-DRA	major histocompatibility complex, class	0,8	2,6244
ILMN_174781	6605	SMARCE1	SWI/SNF related, matrix associated, act	0,8	2,0799
ILMN_179591	116988	CENTG3	ArfGAP with GTPase domain, ankyrin re	0,8	2,6244
ILMN_232581	915	CD3D	CD3d molecule, delta (CD3-TCR comple	0,8	2,6244
ILMN_168571	1974	EIF4A2	eukaryotic translation initiation factor 4	0,8	1,5007
ILMN_180441	57228	SMAGP	small cell adhesion glycoprotein	0,8	1,5007
ILMN_181341	5092	PCBD1	pterin-4 alpha-carbinolamine dehydrat	0,8	2,6244
ILMN_165350	1901	EDG1	sphingosine-1-phosphate receptor 1	0,8	2,6244
ILMN_172174	54707	ATPBD1B	GPN-loop GTPase 2	0,8	2,6244
ILMN_324381	4695	NDUFA2	NADH dehydrogenase (ubiquinone) 1 a	0,8	1,0331
ILMN_166081	6050	RNH1	ribonuclease/angiogenin inhibitor 1	0,8	2,6244
ILMN_173034	84317	CCDC115	coiled-coil domain containing 115	0,8	2,0799
ILMN_165970	689	BTF3	basic transcription factor 3	0,8	1,5007
ILMN_225371	7903	ST8SIA4	ST8 alpha-N-acetyl-neuraminide alpha-	0,8	1,8141
ILMN_212021	10231	RCAN2	regulator of calcineurin 2	0,8	2,6244
ILMN_174334	113189	CHST14	carbohydrate (N-acetylgalactosamine 4	0,8	2,6244
ILMN_175921	118	ADD1	adducin 1 (alpha)	0,8	1,2499
ILMN_167681	116835	HSPA12B	heat shock 70kD protein 12B	0,8	1,8141
ILMN_176901	5547	PRCP	prolylcarboxypeptidase (angiotensinase	0,8	2,0799
ILMN_234021	5142	PDE4B	phosphodiesterase 4B, cAMP-specific	0,8	0,0000
ILMN_180071	23180	RFTN1	raftlin, lipid raft linker 1	0,8	2,6244
ILMN_233724	6210	RPS15A	ribosomal protein S15a	0,8	1,0331
ILMN_167801	9425	CDYL	chromodomain protein, Y-like	0,8	1,8141
ILMN_165901	3111	HLA-DOA	major histocompatibility complex, class	0,8	1,8141
ILMN_180831	9744	ACAP1	ArfGAP with coiled-coil, ankyrin repeat	0,8	2,0799
ILMN_168040	6748	SSR4	signal sequence receptor, delta	0,8	2,6244
ILMN_207961	3820	KLRB1	killer cell lectin-like receptor subfamily	0,8	1,2499
ILMN_181290	116159	CYYR1	cysteine/tyrosine-rich 1	0,8	2,0799
ILMN_179734	23048	FNBP1	formin binding protein 1	0,8	2,0799
ILMN_178231	5430	POLR2A	polymerase (RNA) II (DNA directed) pol	0,8	1,5007
ILMN_220501	57692	MAGEE1	melanoma antigen family E, 1	0,8	2,0799
ILMN_235201	9289	GPR56	G protein-coupled receptor 56	0,8	0,0000
ILMN_179171	1375	CPT1B	carnitine palmitoyltransferase 1B (mus	0,8	2,6244
ILMN_167971	104	ADARB1	adenosine deaminase, RNA-specific, B1	0,8	2,6244
ILMN_238301	6139	RPL17	ribosomal protein L17	0,8	2,0799
ILMN_232510	408	ARRB1	arrestin, beta 1	0,8	0,8244
ILMN_180381	84518	CNFN	cornifelin	0,8	2,6244
ILMN_166801	90952	ESAM	endothelial cell adhesion molecule	0,8	2,6244
ILMN_177751	3695	ITGB7	integrin, beta 7	0,8	1,5007
ILMN_166571	1434	CSE1L	CSE1 chromosome segregation 1-like (y	0,8	2,6244
ILMN_235230	9770	RASSF2	Ras association (RalGDS/AF-6) domain f	0,8	2,6244
ILMN_181511	4628	MYH10	myosin, heavy chain 10, non-muscle	0,8	2,6244
ILMN_167721	55217	TMLHE	trimethyllysine hydroxylase, epsilon	0,8	2,0799
ILMN_165191	8460	TPST1	tyrosylprotein sulfotransferase 1	0,8	1,2499
ILMN_167791	51292	GMPR2	guanosine monophosphate reductase 2	0,8	1,2499
ILMN_211790	7570	ZNF22	zinc finger protein 22 (KOX 15)	0,8	2,6244

ILMN_170060	84282	RNF135	ring finger protein 135	0,8	2,6244
ILMN_178089	5583	PRKCH	protein kinase C, eta	0,8	0,7857
ILMN_177544	5217	PFN2	profilin 2	0,8	2,6244
ILMN_177544	8082	SSPN	sarcospan	0,8	2,0799
ILMN_323941	100128927	ZBTB42	zinc finger and BTB domain containing 42	0,8	1,5007
ILMN_179753	84269	CHCHD5	coiled-coil-helix-coiled-coil-helix domain containing 5	0,8	2,6244
ILMN_219168	51142	CHCHD2	coiled-coil-helix-coiled-coil-helix domain containing 2	0,8	2,0799
ILMN_169401	27335	EIF3K	eukaryotic translation initiation factor 3 subunit K	0,8	0,8244
ILMN_178138	5239	PGM5	phosphoglucomutase 5	0,8	1,8141
ILMN_175133	10616	RBCK1	RanBP-type and C3HC4-type zinc finger protein 1	0,8	1,8141
ILMN_165570	54460	MRPS21	mitochondrial ribosomal protein S21	0,8	1,8141
ILMN_178314	6192	RPS4Y1	ribosomal protein S4, Y-linked 1	0,8	1,5007
ILMN_232650	834	CASP1	caspase 1, apoptosis-related cysteine protease	0,8	2,6244
ILMN_208701	54543	TOMM7	translocase of outer mitochondrial membrane 7	0,8	2,0799
ILMN_173951	78987	CRELD1	cysteine-rich with EGF-like domains 1	0,8	1,2499
ILMN_170951	5239	PGM5	phosphoglucomutase 5	0,8	1,8141
ILMN_181130	2494	NR5A2	nuclear receptor subfamily 5, group A, member 2	0,8	1,8141
ILMN_177611	5414	SEPT4	septin 4	0,8	1,8141
ILMN_173571	3764	KCNJ8	potassium inwardly-rectifying channel, subfamily J, member 8	0,8	2,0799
ILMN_175581	85360	SYDE1	synapse defective 1, Rho GTPase, homolog 1	0,8	2,0799
ILMN_208761	79901	CYBRD1	cytochrome b reductase 1	0,8	2,0799
ILMN_238264	11043	MID2	midline 2	0,8	2,0799
ILMN_216761	4666	NACA	nascent polypeptide-associated complex 1	0,8	2,0799
ILMN_215450	4736	RPL10A	ribosomal protein L10a	0,8	2,0799
ILMN_167110	2701	GJA4	gap junction protein, alpha 4, 37kDa	0,8	1,0331
ILMN_233451	3183	HNRNPC	heterogeneous nuclear ribonucleoprotein C	0,8	2,0799
ILMN_165681	5947	RBP1	retinol binding protein 1, cellular	0,8	2,6244
ILMN_169901	8550	MAPKAPK5	mitogen-activated protein kinase-activated protein kinase 5	0,8	1,0331
ILMN_213994	6189	RPS3A	ribosomal protein S3A	0,8	0,8244
ILMN_173654	151473	SLC16A14	solute carrier family 16, member 14 (monovalent)	0,8	1,5007
ILMN_171160	25824	PRDX5	peroxiredoxin 5	0,8	1,5007
ILMN_222691	9766	KIAA0247	KIAA0247	0,8	2,0799
ILMN_236851	115290	FBXO17	F-box protein 17	0,8	2,0799
ILMN_171151	1690	COCH	coagulation factor C homolog, cochlin (mouse)	0,8	1,2499
ILMN_176121	2132	EXT2	exostosin 2	0,8	1,5007
ILMN_207301	94107	TMEM203	transmembrane protein 203	0,8	2,0799
ILMN_174961	8454	CUL1	cullin 1	0,8	1,0331
ILMN_171641	65057	ACD	adrenocortical dysplasia homolog (mouse)	0,8	1,2499
ILMN_167401	54543	TOMM7	translocase of outer mitochondrial membrane 7	0,8	1,2499
ILMN_231941	689	BTF3	basic transcription factor 3	0,8	2,0799
ILMN_176274	6138	RPL15	ribosomal protein L15	0,8	1,5007
ILMN_176514	3455	IFNAR2	interferon (alpha, beta and omega) receptor 2	0,8	2,6244
ILMN_173941	5396	PRRX1	paired related homeobox 1	0,8	2,6244
ILMN_169201	4692	NDN	necdin homolog (mouse)	0,8	2,6244
ILMN_174941	64983	MRPL32	mitochondrial ribosomal protein L32	0,8	1,8141
ILMN_181041	83871	RAB34	RAB34, member RAS oncogene family	0,8	1,2499

ILMN_173061	408	ARRB1	arrestin, beta 1	0,8	2,0799
ILMN_181023	90423	ATP6V1E2	ATPase, H+ transporting, lysosomal 31k	0,8	2,0799
ILMN_210127	64407	RGS18	regulator of G-protein signaling 18	0,8	1,5007
ILMN_324531	84747	UNC119B	unc-119 homolog B (C. elegans)	0,8	2,6244
ILMN_181169	117246	FTSJ3	FtsJ homolog 3 (E. coli)	0,8	2,6244
ILMN_168019	55353	LAPTM4B	lysosomal protein transmembrane 4 be	0,8	2,0799
ILMN_176113	286257	C9orf142	chromosome 9 open reading frame 142	0,8	1,2499
ILMN_171456	79026	AHNAK	AHNAK nucleoprotein	0,8	0,0000
ILMN_167876	6993	DYNLT1	dynein, light chain, Tctex-type 1	0,8	2,0799
ILMN_240023	6717	SRI	sorcin	0,8	2,6244
ILMN_176018	11043	MID2	midline 2	0,8	1,8141
ILMN_172047	5253	PHF2	PHD finger protein 2	0,8	1,8141
ILMN_180311	23450	SF3B3	splicing factor 3b, subunit 3, 130kDa	0,8	1,2499
ILMN_180261	83468	GLT8D2	glycosyltransferase 8 domain containin	0,8	1,8141
ILMN_208736	55113	XKR8	XK, Kell blood group complex subunit-r	0,8	1,5007
ILMN_323881	23248	RPRD2	regulation of nuclear pre-mRNA domain	0,8	0,0000
ILMN_180893	6194	RPS6	ribosomal protein S6	0,8	1,2499
ILMN_173831	1938	EEF2	eukaryotic translation elongation factor	0,8	2,0799
ILMN_180071	6167	RPL37	ribosomal protein L37	0,8	2,6244
ILMN_231597	81606	LBH	limb bud and heart development homc	0,8	2,0799
ILMN_165237	222223	KIAA1324L	KIAA1324-like	0,8	2,6244
ILMN_172471	8440	NCK2	NCK adaptor protein 2	0,9	1,5007
ILMN_165933	26610	ELP4	elongation protein 4 homolog (S. cerevi	0,9	2,6244
ILMN_173753	6874	TAF4	TAF4 RNA polymerase II, TATA box binc	0,9	1,8141
ILMN_178451	6383	SDC2	syndecan 2	0,9	2,6244
ILMN_172024	64806	IL25	interleukin 25	0,9	0,8244
ILMN_171891	9802	DAZAP2	DAZ associated protein 2	0,9	0,0000
ILMN_174907	3115	HLA-DPB1	major histocompatibility complex, class	0,9	2,0799
ILMN_176291	9812	KIAA0141	KIAA0141	0,9	1,2499
ILMN_177191	57153	SLC44A2	solute carrier family 44, member 2	0,9	1,8141
ILMN_176714	54816	ZNF280D	zinc finger protein 280D	0,9	1,8141
ILMN_174216	83743	GRWD1	glutamate-rich WD repeat containing 1	0,9	1,0331
ILMN_165251	89853	FAM125B	family with sequence similarity 125, me	0,9	1,2499
ILMN_172871	221395	GPR116	G protein-coupled receptor 116	0,9	2,6244
ILMN_177347	6764	ST5	suppression of tumorigenicity 5	0,9	2,0799
ILMN_169001	9270	ITGB1BP1	integrin beta 1 binding protein 1	0,9	2,6244
ILMN_177371	65005	MRPL9	mitochondrial ribosomal protein L9	0,9	2,6244
ILMN_210183	55353	LAPTM4B	lysosomal protein transmembrane 4 be	0,9	1,8141
ILMN_173131	55486	PARL	presenilin associated, rhomboid-like	0,9	1,5007
ILMN_323951	401115	C4orf48	chromosome 4 open reading frame 48	0,9	2,6244
ILMN_170223	79630	C1orf54	chromosome 1 open reading frame 54	0,9	2,6244
ILMN_177911	23384	CYTSA	sperm antigen with calponin homology	0,9	2,0799
ILMN_172913	55069	C7orf42	transmembrane protein 248	0,9	2,6244
ILMN_168271	8463	TEAD2	TEA domain family member 2	0,9	1,0331
ILMN_179756	116841	SNAP47	synaptosomal-associated protein, 47kD	0,9	2,0799
ILMN_168931	83443	SF3B5	splicing factor 3b, subunit 5, 10kDa	0,9	2,0799

ILMN_173974	126792	B3GALT6	UDP-Gal:betaGal beta 1,3-galactosyltra	0,9	2,6244
ILMN_170630	51241	C14orf112	COX16 cytochrome c oxidase assembly	0,9	2,6244
ILMN_176180	90411	MCFD2	multiple coagulation factor deficiency 2	0,9	2,0799
ILMN_171720	10544	PROCR	protein C receptor, endothelial	0,9	2,0799
ILMN_168304	5504	PPP1R2	protein phosphatase 1, regulatory (inhi	0,9	2,6244
ILMN_166630	93058	COQ10A	coenzyme Q10 homolog A (S. cerevisiae)	0,9	2,6244
ILMN_167960	27352	SGSM3	small G protein signaling modulator 3	0,9	1,8141
ILMN_172564	6612	SUMO3	SMT3 suppressor of mif two 3 homolog	0,9	1,5007
ILMN_235213	2064	ERBB2	v-erb-b2 erythroblastic leukemia viral o	0,9	1,5007
ILMN_167438	10971	YWHAQ	tyrosine 3-monooxygenase/tryptophan	0,9	1,5007
ILMN_219883	2230	FDX1	ferredoxin 1	0,9	2,0799
ILMN_169113	116092	DNTTIP1	deoxynucleotidyltransferase, terminal,	0,9	0,8244
ILMN_240810	24144	TFIP11	tuftelin interacting protein 11	0,9	2,0799
ILMN_167650	5654	HTRA1	HtrA serine peptidase 1	0,9	0,8244
ILMN_167679	4236	MFAP1	microfibrillar-associated protein 1	0,9	2,0799
ILMN_169493	5780	PTPN9	protein tyrosine phosphatase, non-rece	0,9	2,6244
ILMN_180193	10465	PPIH	peptidylprolyl isomerase H (cyclophilin	0,9	0,8244
ILMN_167849	1123	CHN1	chimerin (chimaerin) 1	0,9	2,6244
ILMN_181290	10695	CNPY3	canopy 3 homolog (zebrafish)	0,9	2,0799
ILMN_179703	10436	EMG1	EMG1 nucleolar protein homolog (S. ce	0,9	2,0799
ILMN_223433	80772	GLTPD1	glycolipid transfer protein domain cont	0,9	1,0331
ILMN_205553	55790	CSGALNACT1	chondroitin sulfate N-acetylgalactosam	0,9	1,2499
ILMN_167023	26020	LRP10	low density lipoprotein receptor-relate	0,9	0,8244
ILMN_169710	51759	C9orf78	chromosome 9 open reading frame 78	0,9	1,5007
ILMN_170323	112970	KTI12	KTI12 homolog, chromatin associated (C	0,9	2,6244
ILMN_167720	11178	LZTS1	leucine zipper, putative tumor suppress	0,9	1,8141
ILMN_169349	23478	SEC11A	SEC11 homolog A (S. cerevisiae)	0,9	2,6244
ILMN_180753	55181	C17orf71	smg-8 homolog, nonsense mediated m	0,9	1,8141
ILMN_173519	57019	CIAPIN1	cytokine induced apoptosis inhibitor 1	0,9	1,8141
ILMN_172008	30844	EHD4	EH-domain containing 4	0,9	1,2499
ILMN_170213	2739	GLO1	glyoxalase I	0,9	2,6244
ILMN_167244	6135	RPL11	ribosomal protein L11	0,9	2,6244
ILMN_168783	22928	SEPHS2	selenophosphate synthetase 2	0,9	2,6244
ILMN_165150	8603	FAM193A	family with sequence similarity 193, me	0,9	2,0799
ILMN_166923	7564	ZNF16	zinc finger protein 16	0,9	1,8141
ILMN_174330	7265	TTC1	tetratricopeptide repeat domain 1	0,9	1,0331
ILMN_167273	90550	CCDC109A	mitochondrial calcium uniporter	0,9	2,6244
ILMN_222559	27034	ACAD8	acyl-CoA dehydrogenase family, memb	0,9	1,2499
ILMN_171638	64225	ATL2	atlastin GTPase 2	0,9	1,2499
ILMN_175533	7275	TUB	tubby homolog (mouse)	0,9	0,8244
ILMN_165733	5439	POLR2J	polymerase (RNA) II (DNA directed) pol	0,9	2,0799
ILMN_211483	6135	RPL11	ribosomal protein L11	0,9	2,6244
ILMN_324834	54617	INO80	INO80 homolog (S. cerevisiae)	0,9	1,2499
ILMN_180670	140459	ASB6	ankyrin repeat and SOCS box containin	0,9	2,6244
ILMN_165428	115	ADCY9	adenylate cyclase 9	0,9	1,2499
ILMN_173083	284424	C19orf30	MIR7-3 host gene (non-protein coding)	0,9	2,0799

ILMN_172670	55748	CNDP2	CNDP dipeptidase 2 (metallopeptidase	0,9	1,5007
ILMN_171280	126669	SHE	Src homology 2 domain containing E	0,9	2,0799
ILMN_177510	5136	PDE1A	phosphodiesterase 1A, calmodulin-dep	0,9	2,6244
ILMN_181230	9168	TMSB10	thymosin beta 10	0,9	1,8141
ILMN_170470	22918	CD93	CD93 molecule	0,9	1,5007
ILMN_167590	3459	IFNGR1	interferon gamma receptor 1	0,9	1,8141
ILMN_168510	54942	C9orf6	family with sequence similarity 206, me	0,9	2,0799
ILMN_170410	207063	DHRX	dehydrogenase/reductase (SDR family)	0,9	1,5007
ILMN_179010	3815	KIT	v-kit Hardy-Zuckerman 4 feline sarcoma	0,9	2,6244
ILMN_168860	10782	ZNF274	zinc finger protein 274	0,9	1,2499
ILMN_176010	6804	STX1A	syntaxin 1A (brain)	0,9	1,8141
ILMN_167310	79042	TSEN34	tRNA splicing endonuclease 34 homolog	0,9	2,6244
ILMN_177380	7041	TGFB11	transforming growth factor beta 1 indu	0,9	2,6244
ILMN_172440	23464	GCAT	glycine C-acetyltransferase	0,9	2,0799
ILMN_170760	10686	CLDN16	claudin 16	0,9	1,8141

Supplemental Figure 2

Supplemental Figure 1

Gene ID	ID	Gene ID	NAME	fold change	p-value(%)
ILMN_207533	8364	HIST1H4C	histone cluster 1, H4c	10,6	1,8141
ILMN_325140	64710	NUCKS1	nuclear casein kinase and cyclin-depen	8,6	1,0331
ILMN_211353	51449	PCYOX1	prenylcysteine oxidase 1	7,7	1,5007
ILMN_213007	91368	CDKN2AIPNL	CDKN2A interacting protein N-terminal	7,7	0,3847
ILMN_166133	6711	SPTBN1	spectrin, beta, non-erythrocytic 1	6,8	1,5007
ILMN_211594	84124	ZNF394	zinc finger protein 394	6,3	1,8141
ILMN_241574	26118	WSB1	WD repeat and SOCS box containing 1	6,3	1,2499
ILMN_205190	126272	EID2B	EP300 interacting inhibitor of different	6,1	1,2499
ILMN_211373	157777	C8orf45	minichromosome maintenance domain	6,0	0,3847
ILMN_323717	84142	FAM175A	family with sequence similarity 175, m	6,0	0,6097
ILMN_222749	256051	ZNF549	zinc finger protein 549	5,9	1,5007
ILMN_169214	7561	ZNF14	zinc finger protein 14	5,8	0,3847
ILMN_231388	91120	ZNF682	zinc finger protein 682	5,7	0,7969
ILMN_217688	7620	ZNF69	zinc finger protein 69	5,7	1,8141
ILMN_215029	55033	FKBP14	FK506 binding protein 14, 22 kDa	5,7	1,5007
ILMN_221038	200728	TMEM17	transmembrane protein 17	5,6	1,8141
ILMN_211071	1138	CHRNA5	cholinergic receptor, nicotinic, alpha 5	5,6	1,5007
ILMN_172249	142679	DUSP19	dual specificity phosphatase 19	5,6	1,8141
ILMN_228603	117155	CATSPER2	cation channel, sperm associated 2	5,5	0,3847
ILMN_221538	317781	DDX51	DEAD (Asp-Glu-Ala-Asp) box polypeptic	5,5	0,3847
ILMN_173503	1316	KLF6	Kruppel-like factor 6	5,5	1,5007
ILMN_324163	84109	QRFPR	pyroglutamylated RFamide peptide rec	5,5	0,7969
ILMN_212253	147372	CCBE1	collagen and calcium binding EGF dom	5,4	0,3847
ILMN_166153	54741	LEPROT	leptin receptor overlapping transcript	5,4	0,6097
ILMN_218813	339231	ARL16	ADP-ribosylation factor-like 16	5,3	0,3847
ILMN_172134	84061	MAGT1	magnesium transporter 1	5,3	1,0331
ILMN_323818	399761	BMS1P5	BMS1 pseudogene 5	5,3	0,7969
ILMN_220618	57477	SHROOM4	shroom family member 4	5,2	1,8141
ILMN_223574	56850	GRIPAP1	GRIP1 associated protein 1	5,1	1,0331
ILMN_220490	7516	XRCC2	X-ray repair complementing defective r	5,0	1,5007
ILMN_233424	1385	CREB1	cAMP responsive element binding prot	5,0	1,2499
ILMN_228573	55775	TDP1	tyrosyl-DNA phosphodiesterase 1	5,0	1,8141
ILMN_215433	9723	SEMA3E	sema domain, immunoglobulin domain	4,9	2,0799
ILMN_223578	81033	KCNH6	potassium voltage-gated channel, subf	4,9	0,3847
ILMN_175103	162073	ITPRIPL2	inositol 1,4,5-trisphosphate receptor in	4,9	1,0331
ILMN_223010	641737	FLJ44124	uncharacterized LOC641737	4,9	0,3847
ILMN_178570	56203	LMOD3	leiomodrin 3 (fetal)	4,8	1,5007
ILMN_207873	84334	C14orf153	apoptogenic 1	4,8	1,2499
ILMN_171040	5700	PSMC1	proteasome (prosome, macropain) 26S	4,8	0,7969
ILMN_207854	154791	HSPC268	chromosome 7 open reading frame 55	4,7	1,0331
ILMN_216230	11144	DMC1	DMC1 dosage suppressor of mck1 hom	4,7	1,5007
ILMN_219481	649598	FLJ46309	hypothetical protein LOC649598	4,7	0,3847
ILMN_212843	1601	DAB2	disabled homolog 2, mitogen-responsiv	4,7	1,5007
ILMN_212333	64167	LRAP	endoplasmic reticulum aminopeptidase	4,7	1,2499
ILMN_211750	64789	DEM1	defects in morphology 1 homolog (S. cr	4,7	1,2499

ILMN_207579	126205	NLRP8	NLR family, pyrin domain containing 8	4,7	0,3847
ILMN_177249	92014	MCART1	solute carrier family 25, member 51	4,6	0,3847
ILMN_173600	79693	YRDC	yrnC domain containing (E. coli)	4,5	0,7969
ILMN_169140	5718	PSMD12	proteasome (prosome, macropain) 26S	4,5	0,6097
ILMN_167970	51449	PCYOX1	prenylcysteine oxidase 1	4,4	1,5007
ILMN_209110	80867	HCG2P7	HLA complex group 2 pseudogene 7	4,3	1,2499
ILMN_213970	22998	LIMCH1	LIM and calponin homology domains 1	4,3	1,5007
ILMN_204930	151194	FAM119A	methyltransferase like 21A	4,2	1,2499
ILMN_236110	64393	ZMAT3	zinc finger, matrin-type 3	4,2	1,5007
ILMN_173740	1316	KLF6	Kruppel-like factor 6	4,2	2,0799
ILMN_168020	25862	USP49	ubiquitin specific peptidase 49	4,1	0,3847
ILMN_323540	84278	HIATL2	hippocampus abundant transcript-like	4,1	1,0331
ILMN_207350	25764	C15orf63	chromosome 15 open reading frame 63	4,1	1,2499
ILMN_211780	503632	DUXAP3	double homeobox A pseudogene 3	4,1	1,0331
ILMN_215040	64417	C5orf28	chromosome 5 open reading frame 28	4,1	1,2499
ILMN_227980	158399	ZNF483	zinc finger protein 483	4,1	1,5007
ILMN_240780	54756	IL17RD	interleukin 17 receptor D	4,0	0,7969
ILMN_210660	8548	BLZF1	basic leucine zipper nuclear factor 1	4,0	1,5007
ILMN_324560	147172	LRR37B2	leucine rich repeat containing 37B pseudogene 2	4,0	1,0331
ILMN_168010	10087	COL4A3BP	collagen, type IV, alpha 3 (Goodpasture)	4,0	1,2499
ILMN_322510	148203	ZNF738	zinc finger protein 738	4,0	1,0331
ILMN_227930	2204	FCAR	Fc fragment of IgA, receptor for	4,0	2,6244
ILMN_224940	10558	SPTLC1	serine palmitoyltransferase, long chain	4,0	0,3847
ILMN_169370	250	ALPP	alkaline phosphatase, placental	3,9	1,2499
ILMN_168170	2309	FOXO3	forkhead box O3	3,9	1,8141
ILMN_324430	202243	CCDC125	coiled-coil domain containing 125	3,9	0,6097
ILMN_240110	9698	PUM1	pumilio homolog 1 (Drosophila)	3,9	1,2499
ILMN_227670	23509	POFUT1	protein O-fucosyltransferase 1	3,9	1,8141
ILMN_237010	3192	HNRNPU	heterogeneous nuclear ribonucleoprotein U	3,8	1,2499
ILMN_174490	22836	RHOBTB3	Rho-related BTB domain containing 3	3,8	1,5007
ILMN_181210	8396	PIP5K2B	phosphatidylinositol-5-phosphate 4-kinase class B	3,7	0,3847
ILMN_210660	8548	BLZF1	basic leucine zipper nuclear factor 1	3,7	0,7969
ILMN_323630	205327	C2orf69	chromosome 2 open reading frame 69	3,7	0,7969
ILMN_238150	27297	CRCP	CGRP receptor component	3,7	0,3847
ILMN_221170	400866	C21orf24	long intergenic non-protein coding RNA 24	3,6	1,2499
ILMN_205910	79939	SLC35E1	solute carrier family 35, member E1	3,6	0,3847
ILMN_181410	6925	TCF4	transcription factor 4	3,6	1,2499
ILMN_167160	51478	HSD17B7	hydroxysteroid (17-beta) dehydrogenase class B member 7	3,6	1,2499
ILMN_179850	84515	MCM8	minichromosome maintenance complex component 8	3,6	0,3847
ILMN_169770	55333	SYNJ2BP	synaptojanin 2 binding protein	3,6	1,2499
ILMN_205450	285605	DTWD2	DTW domain containing 2	3,6	0,3847
ILMN_330780	54058	C21orf58	chromosome 21 open reading frame 58	3,5	0,6097
ILMN_168940	26137	ZBTB20	zinc finger and BTB domain containing 20	3,5	1,0331
ILMN_212350	374986	FAM73A	family with sequence similarity 73, member A	3,5	0,3847
ILMN_233420	1385	CREB1	cAMP responsive element binding protein 1	3,5	0,6097
ILMN_205490	63929	XPNPEP3	X-prolyl aminopeptidase (aminopeptidase B)	3,4	1,5007

ILMN_233049	54940 OCIAD1	OCIA domain containing 1	3,4	0,3847
ILMN_221289	84765 ZNF577	zinc finger protein 577	3,4	1,5007
ILMN_207909	58493 C9orf80	chromosome 9 open reading frame 80	3,4	0,6097
ILMN_234249	27068 PPA2	pyrophosphatase (inorganic) 2	3,3	0,3847
ILMN_209109	157657 C8orf37	chromosome 8 open reading frame 37	3,3	0,3847
ILMN_228849	84984 C3orf34	centrosomal protein 19kDa	3,3	1,5007
ILMN_226229	10206 TRIM13	tripartite motif containing 13	3,3	1,5007
ILMN_215810	80264 ZNF430	zinc finger protein 430	3,3	0,7969
ILMN_169809	10395 DLC1	deleted in liver cancer 1	3,3	1,0331
ILMN_167190	7360 UGP2	UDP-glucose pyrophosphorylase 2	3,2	0,7969
ILMN_215539	22834 ZNF652	zinc finger protein 652	3,2	0,3847
ILMN_172679	246243 RNASEH1	ribonuclease H1	3,2	2,0799
ILMN_325179	87178 PNPT1	polyribonucleotide nucleotidyltransferase	3,2	0,7969
ILMN_165599	9701 SAPS2	protein phosphatase 6, regulatory subunit	3,1	1,8141
ILMN_207330	3586 IL10	interleukin 10	3,1	0,3847
ILMN_324929	113277 TMEM106A	transmembrane protein 106A	3,1	0,3847
ILMN_181269	4641 MYO1C	myosin IC	3,1	0,3847
ILMN_218099	387700 SLC16A12	solute carrier family 16, member 12 (mouse)	3,1	0,3847
ILMN_224359	10838 ZNF275	zinc finger protein 275	3,0	0,3847
ILMN_166159	977 CD151	CD151 molecule (Raph blood group)	3,0	0,7969
ILMN_210529	145482 PTGR2	prostaglandin reductase 2	3,0	0,3847
ILMN_216899	8562 DENR	density-regulated protein	3,0	0,6097
ILMN_177820	285966 FLJ40722	family with sequence similarity 115, member 1	3,0	0,3847
ILMN_178639	3842 TNPO1	transportin 1	3,0	2,6244
ILMN_205359	54933 RHBDL2	rhomboid, veinlet-like 2 (Drosophila)	2,9	0,3847
ILMN_180560	90649 ZNF486	zinc finger protein 486	2,9	0,3847
ILMN_222210	55728 N4BP2	NEDD4 binding protein 2	2,9	0,3847
ILMN_205539	8930 MBD4	methyl-CpG binding domain protein 4	2,9	1,2499
ILMN_324509	50807 ASAP1	ArfGAP with SH3 domain, ankyrin repeat	2,8	1,8141
ILMN_171370	136051 ZNF786	zinc finger protein 786	2,8	0,3847
ILMN_239749	10052 GJC1	gap junction protein, gamma 1, 45kDa	2,8	0,7969
ILMN_169439	3382 ICA1	islet cell autoantigen 1, 69kDa	2,8	0,3847
ILMN_176369	89970 RSPRY1	ring finger and SPRY domain containing	2,8	1,8141
ILMN_322660	642280 MGC26356	zinc finger protein 876, pseudogene	2,8	0,7969
ILMN_168109	10555 AGPAT2	1-acylglycerol-3-phosphate O-acyltransferase	2,7	1,8141
ILMN_169199	10983 CCNI	cyclin I	2,7	1,0331
ILMN_176129	5143 PDE4C	phosphodiesterase 4C, cAMP-specific	2,7	0,3847
ILMN_172120	1438 CSF2RA	colony stimulating factor 2 receptor, alpha	2,7	0,3847
ILMN_236339	8740 TNFSF14	tumor necrosis factor (ligand) superfamily 14	2,7	1,0331
ILMN_238310	27072 VPS41	vacuolar protein sorting 41 homolog (S. pombe)	2,7	0,3847
ILMN_210509	26258 PLDN	pallidin homolog (mouse)	2,6	0,3847
ILMN_166709	55066 PDPR	pyruvate dehydrogenase phosphatase	2,6	1,8141
ILMN_208919	94056 SYAP1	synapse associated protein 1	2,6	0,3847
ILMN_169019	401494 PTPLAD2	protein tyrosine phosphatase-like A domain	2,6	0,3847
ILMN_165909	9475 ROCK2	Rho-associated, coiled-coil containing protein kinase 2	2,6	1,5007
ILMN_240569	330 BIRC3	baculoviral IAP repeat containing 3	2,6	1,5007

ILMN_325160	54813 KLHL28	kelch-like 28 (Drosophila)	2,6	1,0331
ILMN_171107	653489 LOC653489	RANBP2-like and GRIP domain containi	2,5	0,7969
ILMN_180850	30011 SH3KBP1	SH3-domain kinase binding protein 1	2,5	1,8141
ILMN_205140	87178 PNPT1	polyribonucleotide nucleotidyltransfer	2,5	0,6097
ILMN_217509	56165 TDRD1	tudor domain containing 1	2,5	2,0799
ILMN_181420	54943 C21orf55	DnaJ (Hsp40) homolog, subfamily C, me	2,5	0,7969
ILMN_224357	79864 C11orf63	chromosome 11 open reading frame 63	2,5	0,3847
ILMN_231697	10859 LILRB1	leukocyte immunoglobulin-like recepto	2,4	1,0331
ILMN_237649	1438 CSF2RA	colony stimulating factor 2 receptor, al	2,4	0,6097
ILMN_324023	140771 SMCR5	Smith-Magenis syndrome chromosome	2,4	0,3847
ILMN_173067	374860 ANKRD30B	ankyrin repeat domain 30B	2,4	1,0331
ILMN_177849	3606 IL18	interleukin 18 (interferon-gamma-indu	2,4	1,0331
ILMN_222037	285855 RPL7L1	ribosomal protein L7-like 1	2,4	0,7969
ILMN_173670	226 ALDOA	aldolase A, fructose-bisphosphate	2,4	2,6244
ILMN_216100	126626 GABPB2	GA binding protein transcription factor	2,4	0,7969
ILMN_240190	146059 CDAN1	codanin 1	2,4	0,6097
ILMN_222819	221322 C6orf170	chromosome 6 open reading frame 170	2,4	0,7969
ILMN_181310	117248 GALNTL2	UDP-N-acetyl-alpha-D-galactosamine:p	2,4	2,6244
ILMN_181557	7766 ZNF223	zinc finger protein 223	2,3	0,3847
ILMN_210169	54799 MBTD1	mbt domain containing 1	2,3	2,6244
ILMN_169149	4826 NNAT	neuronatin	2,3	2,0799
ILMN_216128	57464 FAM40B	family with sequence similarity 40, me	2,3	0,3847
ILMN_210638	9966 TNFSF15	tumor necrosis factor (ligand) superfan	2,3	1,5007
ILMN_215229	6752 SSTR2	somatostatin receptor 2	2,3	1,2499
ILMN_227327	57835 SLC4A5	solute carrier family 4, sodium bicarbo	2,3	0,3847
ILMN_240479	6817 SULT1A1	sulfotransferase family, cytosolic, 1A, p	2,3	0,0000
ILMN_180393	286451 YIPF6	Yip1 domain family, member 6	2,3	1,2499
ILMN_326018	401082 FLJ25363	uncharacterized LOC401082	2,3	0,7969
ILMN_209374	79862 ZNF669	zinc finger protein 669	2,3	0,3847
ILMN_165349	84839 RAXL1	retina and anterior neural fold homeok	2,2	0,3847
ILMN_174513	23543 RBM9	RNA binding protein, fox-1 homolog (C	2,2	1,5007
ILMN_176017	64121 RRAGC	Ras-related GTP binding C	2,2	1,2499
ILMN_222490	201895 C4orf34	chromosome 4 open reading frame 34	2,2	1,8141
ILMN_220999	440503 PLIN5	perilipin 5	2,2	0,3847
ILMN_173849	55142 CEP27	HAUS augmin-like complex, subunit 2	2,2	0,7969
ILMN_209749	27071 DAPP1	dual adaptor of phosphotyrosine and 3	2,2	0,6097
ILMN_210620	284161 GDPD1	glycerophosphodiester phosphodiester	2,2	1,5007
ILMN_178119	4067 LYN	v-yes-1 Yamaguchi sarcoma viral relate	2,2	1,8141
ILMN_223309	26279 PLA2G2D	phospholipase A2, group IID	2,2	0,3847
ILMN_226159	326 AIRE	autoimmune regulator	2,2	0,7969
ILMN_209338	6617 SNAPC1	small nuclear RNA activating complex,	2,2	1,0331
ILMN_168849	8073 PTP4A2	protein tyrosine phosphatase type IVA,	2,2	0,3847
ILMN_204889	80224 NUBPL	nucleotide binding protein-like	2,1	0,3847
ILMN_167660	404093 CUEDC1	CUE domain containing 1	2,1	0,7969
ILMN_176739	367 AR	androgen receptor	2,1	1,5007
ILMN_181129	160728 SLC5A8	solute carrier family 5 (iodide transpor	2,1	0,3847

ILMN_228418	7360 UGP2	UDP-glucose pyrophosphorylase 2	2,1	2,6244
ILMN_165624	79827 ASAM	CXADR-like membrane protein	2,1	2,0799
ILMN_181407	5256 PHKA2	phosphorylase kinase, alpha 2 (liver)	2,1	0,6097
ILMN_178720	84858 ZNF503	zinc finger protein 503	2,1	2,6244
ILMN_204788	56127 PCDHB9	protocadherin beta 9	2,1	0,3847
ILMN_224654	653399 GSTTP2	glutathione S-transferase theta pseudoc	2,1	0,7969
ILMN_207004	152926 PPM1K	protein phosphatase, Mg2+/Mn2+ dep	2,1	1,2499
ILMN_235738	2218 FKTN	fukutin	2,1	0,7969
ILMN_180104	6693 SPN	sialophorin	2,0	2,0799
ILMN_323934	442578 STAG3L3	stromal antigen 3-like 3	2,0	1,5007
ILMN_209697	140469 MYO3B	myosin IIIB	2,0	1,5007
ILMN_167600	22982 DIP2C	DIP2 disco-interacting protein 2 homol	2,0	2,6244
ILMN_181264	196 AHR	aryl hydrocarbon receptor	2,0	0,7969
ILMN_169570	27161 EIF2C2	eukaryotic translation initiation factor 2	2,0	2,0799
ILMN_324640	3187 HNRNPH1	heterogeneous nuclear ribonucleoprote	2,0	0,7969
ILMN_229700	9747 FAM115A	family with sequence similarity 115, me	2,0	1,5007
ILMN_175618	79157 MFSD11	major facilitator superfamily domain co	2,0	1,2499
ILMN_172678	23112 TNRC6B	trinucleotide repeat containing 6B	2,0	0,3847
ILMN_226098	706 TSPO	translocator protein (18kDa)	2,0	1,8141
ILMN_175518	440275 EIF2AK4	eukaryotic translation initiation factor 4	2,0	0,3847
ILMN_174638	7813 EVI5	ecotropic viral integration site 5	2,0	1,0331
ILMN_180618	57680 CHD8	chromodomain helicase DNA binding p	2,0	1,2499
ILMN_179758	1845 DUSP3	dual specificity phosphatase 3	2,0	1,8141
ILMN_232198	64421 DCLRE1C	DNA cross-link repair 1C	2,0	0,3847
ILMN_240618	11025 LILRB3	leukocyte immunoglobulin-like recepto	2,0	0,7969
ILMN_227477	80736 SLC44A4	solute carrier family 44, member 4	2,0	1,2499
ILMN_232400	800 CALD1	caldesmon 1	1,9	1,8141
ILMN_168938	9891 NUAK1	NUAK family, SNF1-like kinase, 1	1,9	1,2499
ILMN_179138	442582 STAG3L2	stromal antigen 3-like 2	1,9	1,2499
ILMN_170800	4134 MAP4	microtubule-associated protein 4	1,9	0,3847
ILMN_235224	166824 RASSF6	Ras association (RalGDS/AF-6) domain	1,9	0,7969
ILMN_177704	90338 ZNF160	zinc finger protein 160	1,9	0,3847
ILMN_323928	6085 RNY3	RNA, Ro-associated Y3	1,9	0,6097
ILMN_214828	10081 PDCD7	programmed cell death 7	1,9	1,2499
ILMN_181508	5292 PIM1	pim-1 oncogene	1,9	1,8141
ILMN_179568	8073 PTP4A2	protein tyrosine phosphatase type IVA,	1,9	1,8141
ILMN_171468	27327 TNRC6A	trinucleotide repeat containing 6A	1,9	1,2499
ILMN_218248	79801 SHCBP1	SHC SH2-domain binding protein 1	1,9	1,0331
ILMN_181568	10955 SERINC3	serine incorporator 3	1,9	1,2499
ILMN_322858	84222 TMEM191A	transmembrane protein 191A (pseudog	1,9	0,3847
ILMN_326968	255031 FLJ35390	uncharacterized LOC255031	1,9	0,3847
ILMN_178910	3652 IPP	intracisternal A particle-promoted poly	1,9	0,7969
ILMN_172178	5469 PPARBP	mediator complex subunit 1	1,9	2,0799
ILMN_175908	115509 ZNF689	zinc finger protein 689	1,9	2,6244
ILMN_172208	55156 ARMC1	armadillo repeat containing 1	1,9	2,0799
ILMN_206468	91966 CXorf40A	chromosome X open reading frame 40,	1,9	2,0799

ILMN_17536	3202 HOXA5	homeobox A5	1,9	0,3847
ILMN_16904	145438 C14orf82	FRMD6 antisense RNA 1 (non-protein c	1,8	0,3847
ILMN_17523	79939 SLC35E1	solute carrier family 35, member E1	1,8	2,0799
ILMN_16913	6772 STAT1	signal transducer and activator of trans	1,8	2,0799
ILMN_23962	27250 PDCD4	programmed cell death 4 (neoplastic tr	1,8	0,7969
ILMN_23360	55714 ODZ3	odz, odd Oz/ten-m homolog 3 (Drosop	1,8	2,6244
ILMN_17489	83734 ATG10	autophagy related 10	1,8	1,8141
ILMN_22259	2730 GCLM	glutamate-cysteine ligase, modifier sub	1,8	1,2499
ILMN_17656	10056 FARSLB	phenylalanyl-tRNA synthetase, beta su	1,8	1,0331
ILMN_23514	50863 NTM	neurotrimin	1,8	1,8141
ILMN_17386	286354 C9orf130	chromosome 9 open reading frame 130	1,8	0,7969
ILMN_23461	79230 ZNF557	zinc finger protein 557	1,8	0,3847
ILMN_32266	11145 PLA2G16	phospholipase A2, group XVI	1,8	2,0799
ILMN_20926	124801 LSM12	LSM12 homolog (S. cerevisiae)	1,8	1,8141
ILMN_17031	57226 LYRM2	LYR motif containing 2	1,8	0,3847
ILMN_17873	65068 ALS2CR14	amyotrophic lateral sclerosis 2 (juvenil	1,8	0,3847
ILMN_18094	10357 HMGB1L1	high mobility group box 1 pseudogene	1,7	2,6244
ILMN_18039	51768 TM7SF3	transmembrane 7 superfamily member	1,7	1,5007
ILMN_22708	54663 WDR74	WD repeat domain 74	1,7	1,0331
ILMN_17026	84617 TUBB6	tubulin, beta 6 class V	1,7	0,7969
ILMN_21572	6718 AKR1D1	aldo-keto reductase family 1, member	1,7	1,8141
ILMN_17978	23512 SUZ12	suppressor of zeste 12 homolog (Drosc	1,7	1,2499
ILMN_16790	81931 ZNF93	zinc finger protein 93	1,7	0,3847
ILMN_21754	54516 MTRF1L	mitochondrial translational release fac	1,7	0,7969
ILMN_23626	8824 CES2	carboxylesterase 2	1,7	0,6097
ILMN_17091	497262 RUNDC2C	RUN domain containing 2C	1,7	0,3847
ILMN_23941	55471 PRO1853	chromosome 2 open reading frame 56	1,7	0,3847
ILMN_16798	51186 WBP5	WW domain binding protein 5	1,7	0,7969
ILMN_22194	79056 PRRG4	proline rich Gla (G-carboxyglutamic aci	1,7	0,7969
ILMN_23705	54739 XAF1	XIAP associated factor 1	1,7	1,5007
ILMN_33067	54502 RBM47	RNA binding motif protein 47	1,7	1,2499
ILMN_18155	3203 HOXA6	homeobox A6	1,7	0,7969
ILMN_23937	10093 ARPC4	actin related protein 2/3 complex, sub	1,7	2,0799
ILMN_16575	91057 CCDC34	coiled-coil domain containing 34	1,7	1,0331
ILMN_24144	5935 RBM3	RNA binding motif (RNP1, RRM) protein	1,7	0,3847
ILMN_21802	9980 DOPEY2	dopey family member 2	1,7	1,8141
ILMN_21882	9140 ATG12	autophagy related 12	1,6	0,7969
ILMN_16615	9729 KIAA0408	KIAA0408	1,6	1,0331
ILMN_23876	1235 CCR6	chemokine (C-C motif) receptor 6	1,6	2,0799
ILMN_33014	729324 LOC729324	hCG1986447	1,6	1,2499
ILMN_24080	1936 EEF1D	eukaryotic translation elongation facto	1,6	2,6244
ILMN_17092	81790 RNF170	ring finger protein 170	1,6	1,5007
ILMN_20583	9475 ROCK2	Rho-associated, coiled-coil containing p	1,6	1,8141
ILMN_16853	374928 ZNF773	zinc finger protein 773	1,6	0,3847
ILMN_22150	23594 ORC6L	origin recognition complex, subunit 6	1,6	1,0331
ILMN_20917	123688 LOC123688	aminoglycoside phosphotransferase dc	1,6	1,8141

ILMN_178306	788	SLC25A20	solute carrier family 25 (carnitine/acylc	1,6	0,3847
ILMN_324538	344787	ZNF860	zinc finger protein 860	1,6	0,6097
ILMN_176064	3200	HOXA3	homeobox A3	1,6	2,0799
ILMN_213378	399967	PATE2	prostate and testis expressed 2	1,6	0,7969
ILMN_236482	8473	OGT	O-linked N-acetylglucosamine (GlcNAc)	1,6	1,0331
ILMN_176950	54965	PIGX	phosphatidylinositol glycan anchor bio:	1,6	0,3847
ILMN_168537	25870	SUMF2	sulfatase modifying factor 2	1,6	2,0799
ILMN_237908	84901	NFATC2IP	nuclear factor of activated T-cells, cyto	1,6	0,3847
ILMN_168332	6482	ST3GAL1	ST3 beta-galactoside alpha-2,3-sialyltra	1,5	1,5007
ILMN_168517	311	ANXA11	annexin A11	1,5	0,3847
ILMN_169282	64718	UNKL	unkempt homolog (Drosophila)-like	1,5	1,5007
ILMN_173120	57714	RNF213	KIAA1618	1,5	0,6097
ILMN_177162	6629	SNRPB2	small nuclear ribonucleoprotein polype	1,5	1,8141
ILMN_169970	372	ARCN1	archain 1	1,5	1,8141
ILMN_236302	5888	RAD51	RAD51 homolog (S. cerevisiae)	1,5	0,3847
ILMN_236554	7862	BRPF1	bromodomain and PHD finger containi	1,5	0,3847
ILMN_180290	51588	PIAS4	protein inhibitor of activated STAT, 4	1,5	0,3847
ILMN_218478	150274	HSCB	HscB iron-sulfur cluster co-chaperone h	1,5	1,0331
ILMN_169938	84820	POLR2J4	polymerase (RNA) II (DNA directed) pol	1,5	0,0000
ILMN_165252	29797	DKFZp434K1	POM121 transmembrane nucleoporin-	1,5	0,7969
ILMN_173980	54820	NDE1	nudE nuclear distribution E homolog 1	1,5	0,7969
ILMN_330442	728640	LOC728640	family with sequence similarity 133, m	1,5	0,3847
ILMN_220547	202134	FAM153B	family with sequence similarity 153, m	1,5	2,0799
ILMN_176768	25851	TECPR1	tectonin beta-propeller repeat contain	1,5	0,7969
ILMN_177570	55720	TSR1	TSR1, 20S rRNA accumulation, homolog	1,5	0,7969
ILMN_181198	27246	ZNF364	ring finger protein 115	1,5	0,7969
ILMN_169880	51776	ZAK	sterile alpha motif and leucine zipper c	1,5	2,0799
ILMN_180278	79647	AKIRIN1	akirin 1	1,5	1,8141
ILMN_213042	10945	KDELRL1	KDEL (Lys-Asp-Glu-Leu) endoplasmic re	1,5	1,5007
ILMN_170872	55766	H2AFJ	H2A histone family, member J	1,5	1,5007
ILMN_172227	5048	PAFAH1B1	platelet-activating factor acetylhydrola	1,5	2,0799
ILMN_168158	5770	PTPN1	protein tyrosine phosphatase, non-rec	1,5	1,0331
ILMN_169022	84054	PCDHB19P	protocadherin beta 19 pseudogene	1,5	0,3847
ILMN_172008	79618	HMBOX1	homeobox containing 1	1,5	1,2499
ILMN_323772	55331	ACER3	alkaline ceramidase 3	1,5	0,3847
ILMN_174584	57238	KIAA0492	KIAA0492 protein	1,5	2,6244
ILMN_169988	5900	RALGDS	ral guanine nucleotide dissociation stin	1,4	0,7969
ILMN_177287	55893	ZNF395	zinc finger protein 395	1,4	0,7969
ILMN_173692	7357	UGCG	UDP-glucose ceramide glucosyltransfer	1,4	2,0799
ILMN_176198	6430	SFRS5	serine/arginine-rich splicing factor 5	1,4	1,2499
ILMN_166148	10471	PFDN6	prefoldin subunit 6	1,4	1,0331
ILMN_239442	283635	FAM177A1	family with sequence similarity 177, m	1,4	2,0799
ILMN_214320	541578	CXorf40B	chromosome X open reading frame 40I	1,4	2,6244
ILMN_167102	2591	GALNT3	UDP-N-acetyl-alpha-D-galactosamine:p	1,4	1,8141
ILMN_171498	1629	DBT	dihydrolipoamide branched chain trans	1,4	1,2499
ILMN_324202	493869	GPX8	glutathione peroxidase 8 (putative)	1,4	1,0331

ILMN_16982	5935 RBM3	RNA binding motif (RNP1, RRM) protein	1,4	1,2499
ILMN_32386	93556 C3orf50	EGF-like and EMI domain containing 1,	1,4	1,8141
ILMN_21019	3187 HNRPH1	heterogeneous nuclear ribonucleoprot	1,4	0,6097
ILMN_16558	57146 TMEM159	transmembrane protein 159	1,4	2,0799
ILMN_16623	9406 ZRANB2	zinc finger, RAN-binding domain contai	1,4	0,7969
ILMN_20903	81875 ISG20L2	interferon stimulated exonuclease gen	1,4	2,0799
ILMN_17137	25 ABL1	c-abl oncogene 1, non-receptor tyrosin	1,4	2,0799
ILMN_20729	7156 TOP3A	topoisomerase (DNA) III alpha	1,4	1,2499
ILMN_20956	80008 TMEM156	transmembrane protein 156	1,4	0,7969
ILMN_32401	84298 LLPH	LLP homolog, long-term synaptic facilit	1,4	1,2499
ILMN_17984	23254 KIAA1026	kazrin, periplakin interacting protein	1,4	0,7969
ILMN_16808	5965 RECQL	RecQ protein-like (DNA helicase Q1-like	1,4	0,3847
ILMN_17881	5872 RAB13	RAB13, member RAS oncogene family	1,4	1,5007
ILMN_16784	162966 ZNF600	zinc finger protein 600	1,4	0,7969
ILMN_16514	57222 ERGIC1	endoplasmic reticulum-golgi intermedi	1,4	0,3847
ILMN_16563	5523 PPP2R3A	protein phosphatase 2, regulatory sub	1,4	1,5007
ILMN_17817	2079 ERH	enhancer of rudimentary homolog (Drc	1,4	2,6244
ILMN_21972	11128 POLR3A	polymerase (RNA) III (DNA directed) po	1,4	1,5007
ILMN_21234	656 BMP8B	bone morphogenetic protein 8b	1,4	0,3847
ILMN_17628	9931 HELZ	helicase with zinc finger	1,4	2,0799
ILMN_16828	8209 C21orf33	chromosome 21 open reading frame 3	1,4	1,8141
ILMN_17715	6240 RRM1	ribonucleotide reductase M1	1,4	1,5007
ILMN_32290	728310 LOC728310	golgin A6 family-like 7, pseudogene	1,4	0,7969
ILMN_17410	8396 PIP4K2B	phosphatidylinositol-5-phosphate 4-kir	1,4	1,0331
ILMN_22916	117177 RAB3IP	RAB3A interacting protein (rabin3)	1,3	1,2499
ILMN_17624	200895 DHFRL1	dihydrofolate reductase-like 1	1,3	2,6244
ILMN_17340	338328 GPIHBP1	glycosylphosphatidylinositol anchored	1,3	1,2499
ILMN_21034	162967 ZNF320	zinc finger protein 320	1,3	0,3847
ILMN_18041	222068 TMED4	transmembrane emp24 protein transp	1,3	1,5007
ILMN_17748	55591 VEZT	vezatin, adherens junctions transmem	1,3	0,7969
ILMN_17924	3267 HRB	ArfGAP with FG repeats 1	1,3	1,8141
ILMN_21814	147841 SPC24	SPC24, NDC80 kinetochore complex co	1,3	0,7969
ILMN_16765	10390 CEPT1	choline/ethanolamine phosphotransfe	1,3	0,3847
ILMN_17984	3218 HOXB8	homeobox B8	1,3	2,0799
ILMN_23687	387522 TMEM189-U	TMEM189-UBE2V1 readthrough	1,3	2,0799
ILMN_24012	10144 FAM13A	family with sequence similarity 13, me	1,3	1,2499
ILMN_16684	10350 ABCA9	ATP-binding cassette, sub-family A (AB	1,3	0,7969
ILMN_17710	2617 GARS	glycyl-tRNA synthetase	1,3	2,6244
ILMN_17780	55066 PDPR	pyruvate dehydrogenase phosphatase	1,3	2,6244
ILMN_32364	339736 AK2P2	adenylate kinase 2 pseudogene 2	1,3	0,7969
ILMN_18057	389677 RBM12B	RNA binding motif protein 12B	1,3	0,7969
ILMN_32396	84839 RAX2	retina and anterior neural fold homeok	1,3	0,7969
ILMN_21471	440348 LOC440348	nuclear pore complex interacting prote	1,3	1,5007
ILMN_17425	55149 PAPD1	mitochondrial poly(A) polymerase	1,3	1,0331
ILMN_20579	51101 FAM164A	zinc finger, C2HC-type containing 1A	1,3	0,3847
ILMN_23680	6942 TCF20	transcription factor 20 (AR1)	1,3	0,7969

ILMN_175663	116115	ZNF526	zinc finger protein 526	1,3	2,6244
ILMN_179109	51535	PPHLN1	periphilin 1	1,3	1,8141
ILMN_171889	3225	HOXC9	homeobox C9	1,3	1,8141
ILMN_173104	29896	TRA2A	transformer 2 alpha homolog (Drosophila)	1,3	1,0331
ILMN_240740	10922	FASTK	Fas-activated serine/threonine kinase	1,3	0,3847
ILMN_330813	26834	RNU4-2	RNA, U4 small nuclear 2	1,3	2,6244
ILMN_171408	57563	KLHL8	kelch-like 8 (Drosophila)	1,3	0,7969
ILMN_323860	692205	SNORD89	small nucleolar RNA, C/D box 89	1,3	1,2499
ILMN_171964	9725	TMEM63A	transmembrane protein 63A	1,3	2,0799
ILMN_175340	55095	SAMD4B	sterile alpha motif domain containing 4	1,3	2,6244
ILMN_225963	55904	MLL5	myeloid/lymphoid or mixed-lineage leukemia 5	1,3	2,6244
ILMN_178764	166647	GPR125	G protein-coupled receptor 125	1,3	1,0331
ILMN_174810	1642	DDB1	damage-specific DNA binding protein 1	1,3	0,7969
ILMN_169219	2768	GNA12	guanine nucleotide binding protein (G12)	1,3	2,6244
ILMN_173049	114793	FMNL2	formin-like 2	1,3	2,0799
ILMN_171410	94241	TP53INP1	tumor protein p53 inducible nuclear protein 1	1,3	0,6097
ILMN_173330	83939	EIF2A	eukaryotic translation initiation factor 2A	1,3	1,5007
ILMN_175773	734	OSGIN2	oxidative stress induced growth inhibitor 2	1,3	2,6244
ILMN_217507	6429	SFRS4	serine/arginine-rich splicing factor 4	1,3	2,6244
ILMN_172470	8780	RIOK3	RIO kinase 3 (yeast)	1,3	0,3847
ILMN_173739	4000	LMNA	lamin A/C	1,3	1,5007
ILMN_176564	10371	SEMA3A	sema domain, immunoglobulin domain containing 3A	1,2	2,6244
ILMN_233037	128387	TATDN3	TatD DNase domain containing 3	1,2	1,2499
ILMN_176690	54988	ACSM5	acyl-CoA synthetase medium-chain family 5	1,2	1,2499
ILMN_167684	9975	NR1D2	nuclear receptor subfamily 1, group D, member 2	1,2	2,0799
ILMN_232284	51535	PPHLN1	periphilin 1	1,2	2,6244
ILMN_168347	10452	TOMM40	translocase of outer mitochondrial membrane 40	1,2	1,5007
ILMN_169140	83752	LONP2	lon peptidase 2, peroxisomal	1,2	1,5007
ILMN_324703	26781	SNORA67	small nucleolar RNA, H/ACA box 67	1,2	2,6244
ILMN_167354	127428	C1orf83	transcription elongation factor A (SII) N-terminal domain	1,2	2,0799
ILMN_177603	165324	UBXN2A	UBX domain protein 2A	1,2	1,2499
ILMN_211847	84293	C10orf58	family with sequence similarity 213, member 58	1,2	0,3847
ILMN_324197	246721	POLR2J2	polymerase (RNA) II (DNA directed) polypeptide 2J2	1,2	1,2499
ILMN_324913	81566	CSRNP2	cysteine-serine-rich nuclear protein 2	1,2	1,5007
ILMN_179277	1613	DAPK3	death-associated protein kinase 3	1,2	2,6244
ILMN_165988	26472	PPP1R14B	protein phosphatase 1, regulatory (inhibitor) 14B	1,2	1,8141
ILMN_172718	284390	ZNF763	zinc finger protein 763	1,2	0,3847
ILMN_229099	9973	CCS	copper chaperone for superoxide dismutase	1,2	1,0331
ILMN_218983	51077	FCF1	FCF1 small subunit (SSU) processome component	1,2	2,0799
ILMN_176874	81608	FIP1L1	FIP1 like 1 (S. cerevisiae)	1,2	1,2499
ILMN_231214	90338	ZNF160	zinc finger protein 160	1,2	0,3847
ILMN_171020	79750	ZNF385D	zinc finger protein 385D	1,2	0,7969
ILMN_171030	644591	LOC644591	peptidylprolyl isomerase A (cyclophilin)	1,2	0,3847
ILMN_168273	8870	IER3	immediate early response 3	1,2	0,7969
ILMN_214999	400511	FLJ45256	uncharacterized LOC400511	1,2	0,3847
ILMN_169054	5533	PPP3CC	protein phosphatase 3, catalytic subunit	1,2	1,0331

ILMN_18151:	400931 FLJ27365	MIRLET7B host gene (non-protein coding)	1,2	1,2499
ILMN_17924:	10109 ARPC2	actin related protein 2/3 complex, subunit 2	1,2	2,6244
ILMN_17373:	96459 FNIP1	folliculin interacting protein 1	1,2	1,8141
ILMN_17116:	6477 SIAH1	siah E3 ubiquitin protein ligase 1	1,2	0,7969
ILMN_16954:	5786 PTPRA	protein tyrosine phosphatase, receptor type A	1,2	1,0331
ILMN_17634:	23064 SETX	senataxin	1,2	0,3847
ILMN_17246:	29988 SLC2A8	solute carrier family 2 (facilitated glucose transporter), member 8	1,2	1,2499
ILMN_22290:	10201 NME6	NME/NM23 nucleoside diphosphate kinase 6	1,2	0,3847
ILMN_16633:	991 CDC20	cell division cycle 20 homolog (S. cerevisiae)	1,2	1,8141
ILMN_17194:	4437 MSH3	mutS homolog 3 (E. coli)	1,2	0,3847
ILMN_16559:	22936 ELL2	elongation factor, RNA polymerase II, 2	1,2	1,2499
ILMN_17138:	201895 C4orf34	chromosome 4 open reading frame 34	1,2	0,3847
ILMN_17756:	8672 EIF4G3	eukaryotic translation initiation factor 4 gamma 3	1,2	1,2499
ILMN_32489:	619208 C6orf225	chromosome 6 open reading frame 225	1,2	1,5007
ILMN_17227:	9743 RICS	Rho GTPase activating protein 32	1,2	1,5007
ILMN_17726:	23405 DICER1	dicer 1, ribonuclease type III	1,2	1,0331
ILMN_18009:	5717 PSMD11	proteasome (prosome, macropain) 26S subunit 11	1,2	0,3847
ILMN_17085:	27125 AFF4	AF4/FMR2 family, member 4	1,2	2,0799
ILMN_17755:	1540 CYLD	cylindromatosis (turban tumor syndrome) 1	1,2	0,7969
ILMN_22156:	113457 TUBA3D	tubulin, alpha 3d	1,2	2,0799
ILMN_22835:	54463 FAM134B	family with sequence similarity 134, member B	1,2	1,5007
ILMN_17284:	10565 ARFGEF1	ADP-ribosylation factor guanine nucleotide exchange factor 1	1,2	0,7969
ILMN_17011:	9424 KCNK6	potassium channel, subfamily K, member 6	1,2	0,7969
ILMN_17920:	55596 ZCCHC8	zinc finger, CCHC domain containing 8	1,2	2,0799
ILMN_16808:	10046 MAMLD1	mastermind-like domain containing 1	1,2	0,3847
ILMN_17787:	51421 AMOTL2	angiomin like 2	1,2	0,7969
ILMN_17010:	2055 CLN8	ceroid-lipofuscinosis, neuronal 8 (epilepsy)	1,2	1,0331
ILMN_20986:	3995 FADS3	fatty acid desaturase 3	1,2	2,0799
ILMN_32315:	91584 PLXNA4	plexin A4	1,2	0,7969
ILMN_17225:	905 CCNT2	cyclin T2	1,1	2,0799
ILMN_21971:	55308 DDX19A	DEAD (Asp-Glu-Ala-Asp) box polypeptide 19A	1,1	0,6097
ILMN_16739:	2969 GTF2I	general transcription factor Iii	1,1	2,0799
ILMN_16616:	401475 SRRM1L	serine/arginine repetitive matrix 1 protein like	1,1	1,5007
ILMN_17431:	23215 BAT2D1	proline-rich coiled-coil 2C	1,1	2,0799
ILMN_17912:	85369 FAM40A	family with sequence similarity 40, member A	1,1	2,6244
ILMN_17531:	65125 WNK1	WNK lysine deficient protein kinase 1	1,1	2,6244
ILMN_17827:	90333 ZNF468	zinc finger protein 468	1,1	0,3847
ILMN_17548:	81545 FBXO38	F-box protein 38	1,1	1,0331
ILMN_17429:	7582 ZNF33B	zinc finger protein 33B	1,1	2,0799
ILMN_17348:	4524 MTHFR	methylenetetrahydrofolate reductase (N5, N10-methylen-)	1,1	1,0331
ILMN_17929:	4335 MNT	MAX binding protein	1,1	1,8141
ILMN_17202:	9320 TRIP12	thyroid hormone receptor interactor 1	1,1	2,6244
ILMN_16685:	11037 STON1	stonin 1	1,1	0,7969
ILMN_17251:	6905 TBCE	tubulin folding cofactor E	1,1	1,0331
ILMN_16537:	130617 ZFAND2B	zinc finger, AN1-type domain 2B	1,1	1,2499

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